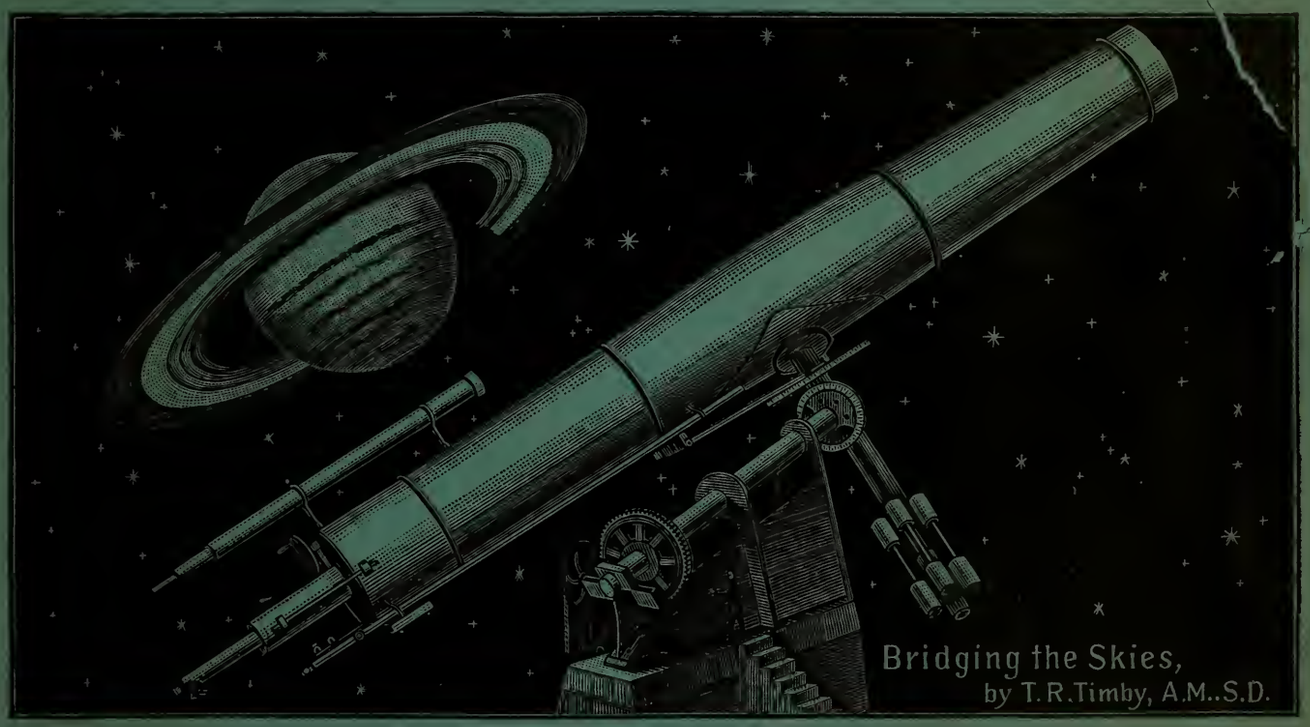
Bridging the Skies,
by T. R. Timby, A.M..S.D.

✓ Timby

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T. Ruggles Timby, A. M., S. D.

1883

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PREFACE.

An hour's entertainment among the stars.

Intellectual and moral force of their study.

The universe, and its breadth.

Telescopes and discoveries, past, present and future.

The Sun and solar worlds.

Comets, their flight, size and purpose.

The stars and star depths.

God's purpose and omnipotence.

I have endeavored to arrange this paper in a way best calculated to ENTERTAIN intelligent people.

I will treat it from my own standpoint, so far as opinion not quoted shall be made a part of the effort, that I alone may be responsible for such heresy as may be discovered in Philosophy, Theory, or Logic, minus accepted endorsement; not forgetting that much of what is accepted in the study of astronomy is deduction from these factors.

It is safe to say that the mind of the student is improved by the study of ANY of the natural sciences, but I know of no other so well calculated to inspire reverence and adoration of the Deity, as the study of the starry universe, and the laws that regulate and govern it; nor is there another study so well calculated to give breadth and elevation to intellectual capacity as the study of the heavens.

A broader knowledge of the skies gives us a better knowledge of their Maker.

Example: They who supposed the world to be flat, and to rest on a rock all the way down, knew less of the great Architect of the Universe, than did Copernicus, Kepler, Galileo, Newton, or the great Leverrier, who told the Berlin astronomers where to look for an undiscovered planet.

I refer to the wonderful discovery of Neptune.

To my reason, the more comprehensive our understanding, especially of this science, the nearer we approach the Deity.

And every new discovery in the grand study of astronomical wonders is the opening of ANOTHER window in the skies, and in the soul.

And while the Godlike spirit in man may lift him up and press him on, to the discovery of countless other worlds, and worlds beyond, through unborn years and the whirl of ages; and the lapse of time

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may add its many fold to his accumulated knowledge of that which "God hath wrought" in the skies, still there will remain a boundless expanse of undiscovered worlds, which can only be considered as coextensive with infinity.

For the universe is as broad as eternity is long!

You may consider the length of the one to be the breadth of the other.

Of this boundless universe, the Solar System, so grand, so vast, and so much beyond our comprehension is comparatively an atom.

This atom we will briefly consider in connection with OTHER worlds vastly more remote than any of the planets.

And in this connection I think something about astronomical instruments, with which to reach, read, reason and study these distant worlds, would interest you.

Then, in brief, I will say, there are two kinds of telescopes now in use. One is known as a reflector, and, I think, of the two this is the more powerful, but there seems to be an impracticability in mounting this kind of glass in a way to make it available to an observer beyond a very limited field.

All have read of Lord Rosse's great telescope. THIS is a reflector, and I suppose it to be the most powerful glass yet constructed, but its availability is so limited (compared with a refractor) as to make its use of but little importance.

What is known as a refractor may be mounted equatorially so as to enable an astronomer to observe every part of the heavens above the horizon.

We will speak of this latter class, as they are the available instruments.

To make a set of large achromatic, refracting lenses, involves great risk and requires great patience, talent and a large capital; and the risk and cost of making is very greatly increased with a very small addition in size and power.

In fact everything pertaining to the making and mounting of a

large telescope requires the highest order of mechanics, combined with mathematical exactness.

It is one thing to properly FINISH a set of LARGE lenses and quite another to make a set of large blank disks, WORTH finishing, and the latter is the ONE GREAT OBSTACLE encountered in each and every attempt in making telescopes.

Finishing requires great skill, but there is less risk in the undertaking.

In the Blank Disk department of telescope making, I believe there are but two parties—Chaunce & Co., of Birmingham, England, and the Philes, of Paris. Both parties have inherited their profession.

I think Kepler attempted the first astronomical glass, but did not succeed.

In this case, as in many other failures, it was a GERM of success.

Then came the great Galileo, with his chromatic glass, and although a crude and imperfect instrument, it was a great and glorious achievement; it was a finger-board pointing direct to other worlds, an open window to the skies.

The next invention in telescopes was by Peter Dolland, of Kensington, England, in 1765.

This was the discovery of a method for producing a perfect achromatic refracting glass.

But as great and important as this discovery was, and is, it added many fold to the difficulty and cost of making; and to-day, the largest mounted set of refracting lenses in the world is but 30 inches in diameter, with a focal length of 45 feet; this instrument is in a Russian Observatory; only 27 inches added to the diameter of Galileo's glass in 170 years.

I believe that Alvan Clarke & Sons, of Cambridgeport, Massachusetts, are the most noted lens makers in the world.

These parties made the lenses for the large equatorial in the Washington Astronomical Observatory.

This glass is 26 inches in diameter; has a focal length of 31½ feet, and cost $50,000.

The 18 inch glass at Cambridge, and the 24 inch glass at Princeton, are of the Clarke's finishing.

All large blanks, however, are made abroad.

The blanks for the 27 inch Vienna glass were made in Paris, and finished in Dublin.

Messrs. Clarke & Sons have lately finished a set of 30 inch lenses for the Russian Government; this instrument has a focal length of a little more than 45 feet.

The same parties have under contract, a set of 36 inch lenses for the Lick Observatory on Mount Hamilton, in California.

This set will have a focal length of about 60 feet, and will not be finished before 1890.

The size and position of the Lick Glass, when completed, promise good results, and the reputation of Count Struve, who has charge of the 30 inch Russian glass, would indicate comparative satisfaction.

There is, of course, a limit to the size and power to which a perfect set of achromatic refracting lenses may be constructed; but that limit is not yet reached and to make a set of 70 inch refracting lenses, with a focal length of 95 feet, I believe to be quite possible.

Such a glass would concentrate nearly five times the light of the great Russian instrument.

It would be a new light to the world, with its concomitant revelations.

It would enable a close inspection of nearly every portion of the planetary system.

Important facts would be revealed in detail, as they really are; differing very much from what they now appear as seen through glasses of inferior power.

It would leave little, if any, of the sun's disk, or the disks of the planets, to hypothesis, and such a power would bridge the way

and light our reason, far beyond the solar realms, the Polar Star, or Milky Way.

With such a glass, the real character of the sun's disk, the mottled face of Venus and of Mars, Jupiter's belts and Saturn's belts and rings, would cease to be mysteries.

Comets would no longer excite fear or speculation.

We would then see that God made these strangers (as they are called) for a special and very important purpose.

And here let me say, the divinity in man, which enables him to go from an intelligent consideration of the anatomy of his hand to a logical hypothesis of the physical constitution of yonder star, in one and the same breath, will, in time, enable him to investigate others of the Solar worlds by BRIDGING THE SKIES with vastly more powerful instruments than any now thought of.

With continued accumulation of knowledge, it is almost certain that discoveries will yet be made in some of the far off worlds; which will result in benefiting, both the mental and physical condition of man.

This conclusion is more in harmony with our reason to-day than would have been an indorsement (forty years ago) of the practical use of the Telegraph, or a similar confidence expressed in the possibilities of the Telephone, a decade since.

There was a time in the history of man, when, with the destruction of a single monument, or library, the records of all human discovery would have perished to the world.

But such a possibility, either by conflagration or revolution, can never again exist in the future of our race.

Neither will there be a time in our future when man will cease to advance in physical and intellectual conquest.

Other routes, and wider logic, will BRIDGE the BROADEST intervening space in the way of his onward and never ending destiny, reaching farther and farther into the depths of immensity, vastly beyond the present visible confines of the universe.

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Comets would no longer excite fear or speculation.

We would then see that God made these strangers (as they are called) for a special and very important purpose.

And here let me say, the dignity in man, which enables him to go from an intelligent consideration of the anatomy of his hand, to a logical hypothesis of the physical constitution of under star, in one and the same breath, will in time, enable him to investigate others of the Solar worlds by extension, and skies with easily more powerful instruments than any now thought of.

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giving power of this great central orb I do not wonder he should have inspired a spirit of adoration in the hearts of unenlightened and superstitious men.

This heathen Deity, however, when but partially investigated, proves to be an incandescent globe, or ball, of living fire, 860,000 miles in diameter, revolving on his axis once in about 25 days.

This would give the rotary motion of the sun at its equator a little more than 100,000 miles in 24 hours, or more than four times the velocity of the earth at its equator.

And there can be no doubt as to his having an annual motion like that of the planets in their revolution, or circuit, around him, but at the present time there are no glasses of sufficient power to enable astronomers to form a valid estimate as to his period, or to locate the centre of his orbit; even an approximate centre of this second motion I regard as but little better than conjecture, CERTAINLY not reliable.

Some astronomers have located this centre somewhere in the pleiades.

It may or may not be correct.

But, like the stars, his revolution around some distant centre is real, together with his retinue of attendant worlds, and it is estimated that this whirl of SHINING worlds are carried forward in space with a velocity equal to 400,000 miles per day.

Different theories have been advanced as to the Sun's physical interior, none of which can ever be proven or disproven.

For, as light as the Sun is, his interior will ever remain in darkness to us. No finite vision will ever penetrate the depths of that stormy, shoreless, ocean of glowing hydrogen.

We have the authority of such men as Professors Proctor, Trouvelot, and others, that storms and cyclones have been observed on the sun's surface to rage with a fury corresponding in force and energy to his temperature, motion, and magnitude.

The same authorities vouch for disturbances of a still more violent and remarkable nature which have been observed on the Sun's

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The same authorities vouch for disturbances of a still more radical and remarkable nature which have been observed on the Sun's

disk. As if by sub-solar explosion, vast volumes of incandescent matter, in mass much larger than the earth, are thrown off to the seemingly incredible distance of 250,000 miles and then drawn back into the sun with a force equal to that which expelled it.

We will regard the Sun's forces as sustained by some immutable law, and that law as making matter perpetual in growth, regular and perfect in chemical changes from primitive, infinitesimal, transparent germs, to the gaseous, liquid, meteoric, and solid, in natural order and purpose for which this law was designed.

We will suppose this matter to pervade infinite space and to gravitate in germs, and in semi-organic or meteoric form, to all the various primaries and their subordinates in the universe, giving energy and vitality to the Sun and volume to the planets.

His vital forces are God's appointed authority for all of nature's physical changes within the limits of the solar domain.

He gives us every zephyr, every cooling breeze, every gale, every cloud, and every storm. He gives us every dew drop, every rain drop, and every flake of snow. He gives us every brooklet, every river, every lake and every inland sea.

From him every leaf, every blade of grass and every flower receives its life, form, tint, and fragrance.

The mountains fall before his face,
  A silent homage seem to pay.
He speeds the floods, their course to trace
  And rolls the tempests on their way.

He frets and calms the restless sea
  And charms to life the frozen land.
He warms the plain, and shades the lea,
  And fans the burning desert sand.

He crowned Himalaya's lofty dome
  And drew the eternal frostline there.
He lights the feet of coming morn.
  And gilds the graceful evening star.

But what is more wonderful than all is, his absence gives us night and with it a universe.

I can conceive of nothing more expressive or beautiful than the following from Blanco White.

"Mysterious night! when our first parent knew thee from report divine and heard thy name, did he not tremble for this lovely frame, this glorious canopy of light and blue? yet, 'neath the curtain of translucent dew! bathed in the rays of the great setting flame, Hesperus, with the host of heaven came, and lo! creation widened in man's view. Who could have thought such darkness lay concealed within thy beams, O, Sun! or who could find, while leaf and insect lay revealed, that to such countless orbs thou mad'st us blind?"

Solar spots have been observed for more than a thousand years, and, like everything else not understood, have been regarded with suspicion.

How often we are reminded of the adage, "They condemn that which they do not understand."

So these spots, like comets, have been regarded with popular fear and apprehension.

It appears to me that God has a special and benevolent purpose in all His work, and I believe these spots on the Sun's disk may have a double purpose, one of which may be to enable us to determine the exact time of the Sun's rotation on his axis. Another purpose may be to teach us charity.

There are times when the Sun's disk appears to be clear, but such are not common.

From 20 to 100 spots may be counted almost any day with the aid of a good glass. They vary in size from 1,000 to 100,000 miles in diameter and represent almost every variety of form and shape.

Some of the largest and most noted of these spots are

"spanned with glowing bridges" many thousands of miles in length and height.

It should be borne in mind that while these spots look black they are by no means so in fact. In reality they are a brilliant red, but "on the glowing face of the Sun they appear black," just as an electric light would appear on the Sun's disk.

We will never be quite certain as to their physical character until we have glasses of much greater power than any now in use or in process of construction.

Probably, however, they are unconsumed cinders of foreign matter drawn into the Sun from time to time, and now helpless hulks on a stormy sea of fire; naturally drifting towards the Sun's equator to be consumed in forces of greater intensity.

Other cinders of a similar kind may take their places from the same natural causes and for the same benevolent purpose.

Next to the Sun is the solar family.

We will review it briefly.

On our route from the Sun to Neptune you will notice of this system of worlds that no two are alike in volume, matter, motion, feature or orbit; and, could we view them closely in detail, we would find their mineral composition and their vegetable and animal production all to differ as widely as do their features.

How wonderful, and yet TRUE, that God seems to make no two things exactly alike. No two grains of sand, of sea or desert; no two rocks or hills, streams, lakes, seas or worlds, are made alike, and all this for a purpose and that purpose we may never fully understand in this life.

At the distance of thirteen millions of miles on our journey, we enter the REPUTED realms of Vulcan.

We would like to make his acquaintance and learn something definite as to his constitutions, his travels and his daily round.

But inquiry develops the surprising fact that his majesty seldom, if ever, allows himself to be interviewed.

He has the reputation, however, of making a journey around the Sun every twenty days. This would make his time about 55,000 miles an hour.

Thirty-six millions of miles on our route we cross the orbit of Mercury.

This planet is 3,000 miles in diameter; revolves on its axis once in twenty-four hours, and makes its journey around the Sun once in eighty-eight days, at the wonderfully rapid motion in space of more than 100,000 miles an hour. Of its surface and atmosphere very little is positively known.

On our way sixty-six millions of miles we enter the orbit of Venus; to us the most brilliant of all the planets.

Venus is 7,500 miles in diameter and revolves on her axis in nearly the same time as the earth, and she makes her circuit around the Sun in 225 days; moving in space 80,000 miles an hour.

Ninety-two millions of miles on our route we find ourselves at home with Mother Earth, enjoying the whirl of a thousand miles an hour in one direction and a thousand miles a minute in another.

There is much of interest that might be said of this planet but I can think of nothing new, for, long since, men have explored every mountain, valley, desert, island, strand; they have rounded every headland, and crossed every waste of sand; they have surveyed every river, delta, lake and bay; they have mapped out every ocean, archipelago, sound and sea.

There is one interesting fact, however, that may have escaped your notice or memory, viz: that the poles of the earth, in the absence of the Sun, have the light of the moon.

Then in the zig-zag path of the moon we may see not only God's purpose but his method of giving light to the polar regions. I think they are blind indeed who cannot see God in this.

At the distance of 140 millions of miles on our way we cross the orbit of the Dusky Warrior, Mars, as he is called. A brief survey of his surroundings makes him 14,000 miles in girth.

He has the mountain journey to make a second time before the sun sets twenty days. This would seem to be one than [illegible] as been.

Thirty-six million of miles in one day [illegible] to [illegible] distance.

The planet is [illegible] miles in diameter. Jupiter is [illegible] once in twenty-four hours, and moves in twenty-seven [illegible] in eighty-six days at the [illegible] equal motion in [illegible] [illegible] miles an hour. All its surface and atmosphere [illegible] is probably known.

On one [illegible] million of miles [illegible] Saturn, so in the most [illegible] of all the planets.

Saturn is [illegible] miles in diameter and revolves on its axis in nearly the same time as the earth, and the moons [illegible] around the sun in [illegible] days. Saturn is [illegible] times as [illegible].

Twenty-two million of miles [illegible] Uranus [illegible] [illegible] with Saturn [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible].

There is much of interest that might be said of the planets, but I have [illegible] of making [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

He revolves on his axis in twenty-four hours and forty minutes and makes his circuit around the Sun in 668 of his days, with the velocity in space of 54,000 miles an hour. He has an atmosphere and face very similar to that of the Earth.

He is said to have two satellites.

Between Mars and Jupiter is a zone of about 100 millions of miles in breadth, in which there are a great, but an unknown, number of small planets, varying in size, revolution and orbit. The largest is less than a thousand miles in diameter.

Of their origin there are various theories. One is that they are fragments of a disrupted planet of great dimensions but I cannot harmonize the disruption of worlds with my idea of the Deity.

It has been wisely said, "There is a careful fitting whereby the plan is always moulded to accomplish an end; is everywhere characteristic of nature, and is a continual revelation of its common author."

To me this philosophy would not indicate disruption.

At the mean distance of 475 millions of miles on our route we enter the orbit of Jupiter, the largest of all the planets; in volume larger than ALL the other planets.

He is 88,000 miles in diameter and in volume 1,400 times larger than the earth. He revolves on his axis once in ten hours, making his days and nights five hours each. His circuit around the Sun is made in little less than twelve of our years. His velocity in space is more than 700,000 miles per day. His equatorial diameter exceeds his polar diameter about 5,000 miles. His belts are shifting zones running parallel to his equator.

The physical character of these belts is a problem of great interest to the student and a much more powerful glass than any now in use will be required for its solution.

Jupiter has the attendance of four satellites, or worlds, for one of them is larger than the planet Mercury, and any of them larger than the minor planets between him and Mars.

These satellites differ in color, size, motion and orbit, and their period is from 1½ to 19½ siderial days.

The first and second have a blueish tint, the third is yellow, and the fourth a reddish shade.

On our journey 872 millions of miles we enter the orbit of Saturn. This Deity is the most ancient of all the heathen Gods, and, judging from the number of his retainers and the splendor of his jewels, I should regard him not only the most ancient but the richest prince of them all.

He is 235,000 miles in girth; revolves on his axis once in 10 hours and 30 minutes, and makes the circuit of his immense orbit, of five billions, 250 millions of miles, in 30 terrestrial years, moving in space more than 500,000 miles per day. His volume is 750 times that of the earth.

Besides his retinue of eight satellites, or minor worlds, he has a system of belts and rings surrounding him, all differing in magnitude, tint, motion, and orbit.

These rings vary in breadth of from 10,000 to 18,000 miles, and they, too, revolve around the body of the planet.

The circumference of the ring system is 550,000 miles; their thickness is variously estimated from 100 to 500 miles, and their physical character is unknown.

His different satellites, vary in their orbits and periods. The one nearest him has an orbit of about 300,000 miles in diameter; the one most remote an orbit of four and a half millions of miles in diameter, and the orbits of the other six, of course, are between these two limits.

One billion 754 millions of miles from the Sun we enter the dominion of Uranus. This planet was discovered by Sir William

These satellites differ in color, size, motion and orbit, and their period is from 1.4 to 16.1 sidereal days.

The first and second have a bluish tint, the third is yellow, and the fourth a reddish shade.

On our journey 853 millions of miles we enter the orbit of Saturn. The Deity is the most ancient of all the heathen Gods, and judging from the number of his manners and the splendor of his jewels, I should regard him not only the most ancient but the richest prince of them all.

He is 213,000 miles in girth, revolves on his axis once in 10 hours and 30 minutes, and makes the circuit of his immense orbit, of five billions, 250 millions of miles, in 30 terrestrial years, moving in space more than 500,000 miles per day. His volume is 250 times that of the earth.

Besides his retinue of eight satellites or minor worlds, he has a system of belts and rings surrounding him, all differing in magnitude, unit, motion, and orbit.

These rings vary in breadth of from 10,000 to 18,000 miles, and they, too, revolve around the body of the planet.

The circumference of the ring system is 350,000 miles; their thickness is variously estimated from 100 to 250 miles, and their physical character is unknown.

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One billion 775 millions of miles from the Sun we enter the dominion of Uranus. This planet was discovered by Sir William

Herschel in 1781. It is known to have at least four moons, and their motion, strange to say, is retrograde.

This planet is supposed to be 33,000 miles in diameter and to make his circuit around the Sun in 84 of our years. Little or nothing is known of its constitution, surface, or atmosphere. Its motion in space is 300,000 miles per day.

At a distance of two billions 750 millions of miles from the Sun we have reached the orbit of Neptune, and find ourselves at the end of our solar journey.

This planet was discovered in 1846. Its discovery was the result of calculations made by the great Leverrier, pointing direct to it before discovery, and is regarded the greatest achievement of the human mind.

Neptune is 37,000 miles in diameter and in volume 100 times larger than the earth. He makes his circuit around the Sun in 165 of our years; moving in space 288,000 miles per day.

We next come to that eccentric class of celestial bodies known as comets. They, unlike the planets, appear and disappear in every quarter of the heavens; move in every direction, and seem in no degree subject to the laws which regulate the solar worlds. Were they subject to the laws of attraction and gravitation such of them as came within the solar limit would plunge headlong into the Sun's consuming flames. But, on the contrary, they fearlessly approach his very breath, and, at the bidding of Omnipotence, take their departure to other systems with the same rapidity of flight which marked their advent here.

They always have attracted, and ever will attract, great attention from all classes They have excited the admiration of some and the terror of others.

Their enormous dimensions, their eccentric fiery forms and rapid flight, will always challenge the admiration of intelligent people.

Of their physical character there is much speculation, but very little, if anything, known; and opinion upon this subject I regard of but little importance.

Incandescent, carbonic vapor is supposed, by some astronomers, to be their chief constituent.

It may be interesting to know that the comet of 1882, in its entirety, was hundreds of times larger than the Sun and all the planets.

The comparative size of all the solar worlds to this great comet would be like comparing the size of a mouse to that of a mastadon.

Its motion at perihelion is computed to be 180 times that of the earth in its solar circuit.

Its period is calculated at about 800 years.

In imagination we can see and hear the awful elementary excitement incident to the approaching forces of a comet in continuity with those of the Sun.

Like the meeting of ten thousand electric fiery worlds in space, with salute of all their batteries, the thunders of which would rend the farthest planet did there exist an atmospheric connection to transmit the sound.

The awful grandeur and sublimity of the scene at first seems to paralyze and then to inspire our reason and adoration of the power and purpose which called these fiery envoys to life, and then sent them into the depths of the universe timed and commissioned with authority to impart vitality, force, and balance to our great central orb.

It is said that a comet has been known to move a million miles an hour in passing around the Sun, but I do not believe that comets go around the Sun, but meet and pass before his face and then return to the star depths, in obedience to a mandate from the Supreme Ruler of immensity.

The comet of 1680 came when the temperature of the Sun was computed by Newton to be 2,000 times that of red hot iron, and the

greatest aphelion distance yet computed was that of the comet of 1844, which was 400 billions of miles beyond Neptune.

Professor Trouvelot gives the length of the great comet of 1843 at 200 millions of miles.

A very curious feature to me is this. In approaching the Sun, and receding from it, the nucleus, or head of the comet, always remains toward the Sun, and its train directly from the Sun.

The head of the comet of 1811 was 112,000 miles in diameter, and its tail was 115 millions of miles in length. Its aphelion distance was forty billions of miles. This comet is expected to return in 3,000 years.

Halley's comet, of 1835, was first seen in England in 1066. Dr. Halley was the first to discover its period, and by its period its identity. He traced it back to 130 years B. C. In 1066 it was as large as a full moon. In 1456 its tail reached from the horizon to the zenith; 140 millions of miles. It was then supposed, it is said, to indicate the success of Mahomet II, who had just taken Constantinople, and threatened the whole Christian world.

Pope Calixtus IIId ordered a prayer for everybody as follows: "Lord save us from the devil, the Turk, and the comet."

Donatus' comet, of 1858, was discovered in June, 140 millions of miles from the earth. In October its tail was 50 millions of miles in length. Its nucleus, though comparatively small, has never been exceeded in brilliancy, and the beautiful curvature of its tail is said to have been without a rival in the history of comets. Its period is computed at 2,000 years.

Some astronomers speak of comets as a part of the solar system, but I should no more regard them a part of this system than I should regard Dom Pedro, Emperor of Brazil, as one of our own people.

The same comet is not a very frequent visitor or traveller this way. I would call them envoys, or a part of the plan of the universe.

greatest aphelion distance yet computed was that of the comet of 1843, which was 200 billions of miles beyond Neptune.

Professor Tsuruchy gives the length of the great comet of 1843 at 200 millions of miles.

A very curious feature to me is this. In approaching the Sun and receding from it the nucleus or head of the comet always remains toward the Sun, and its tail directly from the Sun.

The head of the comet of 1843 was 112,000 miles in diameter, and its tail was 215 millions of miles in length. Its aphelion distance was forty billions of miles. This comet is expected to return in 5,000 years.

Halley's comet of 1835 was first seen in England in 1682. Dr. Halley was the first to discover its period and by its period to identify. He traced it back to 130 years B. C. In 1682 it was as large as a full moon. In 1836 its tail reached from the horizon to the zenith, 120 millions of miles. It was then supposed, it is said, to indicate the success of Mahomet II, who had just taken Constantinople, and threatened the whole Christian world.

Pope Calixtus III ordered a prayer for everybody as follows: "Lord save us from the devil, the Turk and the comet."

Donnard comet of 1858 was discovered in June, 190 millions of miles from the earth. In October its tail was 90 millions of miles in length. Its nucleus, though comparatively small, has never been exceeded in brilliancy, and the beautiful curvature of its tail is said to have been without a rival in the history of comets. Its period is computed at 2,000 years.

Some astronomers speak of comets as a part of the solar system, but I should no more regard them a part of this system than I should regard Dom Pedro, Emperor of Brazil, as one of our own people.

The same source is not a very frequent visitor or traveller this way. I would call these envoys, or a part of the plan of the universe

Their magnitude, forms, motions, and in some instances their orbits, are known, all of which are unlike the planets.

Some of these travellers are known to return again in calculated periods, others go away and never return, and I suppose that others take the place of those that do not return; while those whose places are taken here, most likely go to some other part of the universe on equally important missions.

Then let us consider these travellers as special envoys, charged with great and vital powers pertaining to the life, harmony, and equilibrium of that part of the universe, or star cluster, of which our Sun is a humble member.

It is reasonable to suppose, however, their functions to differ as widely as does their appearance; but their PURPOSE and OFFICE in the universe are as important as their existence is real. Their DISTINCTIVE FUNCTIONS we may never know.

But their purpose and constitutions will be better understood in the not far away future, as every decade extends the boundary line of discovery, and every age marks its revolution in human and divine ways and means toward a final consummation of God's purpose.

Immensity, whether of matter or space, if studied, stimulates research, reason, and admiration, and immensity without limit is only found in the star depths; and this we may regard as God's Cabinet of Wonders.

Did it ever occur to you that we were put just far enough from the stars to give us perfect night? and that night, with its dome of shining worlds and burning orbs, is nature's grandest sight and the consummation of all that is grand and sublime within the range of mortal vision?

We may not "see God and live," but we may see something of His Empire and live the better!

I suppose all are aware that the stars are suns to other systems,

very likely similar to our own, each with its escort of attendant worlds, moving through space with rapidity vastly beyond our comprehension. They are known to differ in magnitude, motion, and color. Some are supposed to be a thousand times larger than our Sun. They are known to have at least two very rapid motions in obedience to fixed laws.

In color, some, like our Sun, are yellow, some are white, others blue, some green, others of a reddish tint. Some are known to have two of these colors, others three, and some are said to have them all.

In the pure, transparent atmosphere of tropical regions the color of the stars are more brilliant. There, it is said, the nocturnal sky is sometimes like a blaze of jewels, glittering with the green of the emerald, the blue of the sapphire, and the yellow of the topaz.

In our northern latitude there are no stars visible to the naked eye which appear so distinctly blue or green.

Their colors may result from one of two natural causes. Tinted combustion or a tinted atmosphere surrounding them would produce the same effect.

Of their distance from us nothing is definitely known beyond the fact that the nearest star to us is beyond a certain limit, but how far beyond that limit is to man unknown; and the limit referred to, beyond which the nearest star must be, is as much farther from us than the Sun as the earth is broader than a grain of sand.

Arcturus, a star of the first magnitude, and one of the nearest, is supposed to move in space 200,000 miles an hour, but its distance is so great that a century would not reveal to us a change in its relative position to other stars.

It is so remote that the strongest glass fails to reveal a disk.

We can see, in a clear night, above the horizon of the star cluster which surrounds us, not to exceed 3,000 stars with the unassisted eye.

With a strong glass there are MILLIONS visible! and we should remember this number is only a part of a single cluster, and the

distance between any two in this cluster is likely to be quite as great as the distance between us and them.

At a speed of a thousand miles an hour it would take 2,200,000 years to reach a point a long way this side of the nearest star.

The star depths consist of innumerable clusters, groups, and galaxies, and their visibility is only limited by the penetrating power of the telescope.

These clusters have every conceivable configuration, and they, too, are without number, and we may regard each cluster with its millions to have ITS center around which each and all of the group revolve in perfect time.

Professor Trouvelot estimates the star clusters about us to involve from 30 to 50 millions of Suns.

The great Nebula in Andromeda is supposed to contain thirty millions of stars and as many systems of shining worlds.

It is said that Lord Ross's great reflecting telescope has revealed star clusters so remote as to take their light, at 200,000 miles a second, thirty millions of years to reach the earth.

It is estimated that, with the aid of the best glass, as many as a thousand millions of stars can be seen, and were we to quadruple the penetrating power of our glasses we should quadruple the number of visible stars. Some of them are supposed to be a thousand times larger than our Sun, and we may know each and every star, by birth and law Divine, to be the centre and ruler of an Eternal Empire of shining worlds.

Turn our investigation of the universe in whatever direction we may we see in its face more and more of its breadth, beauty and benevolence, to admire, and more of God to venerate.

We also find God's ETERNAL PURPOSE indelibly stamped on nature's every feature.

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At a speed of a thousand miles an hour it would take [illegible] years to reach a point a long way this side of the nearest star.

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The great Nebula in Andromeda is supposed to contain thirty millions of stars and as many systems of shining worlds.

It is said that Lord Ross's great reflecting telescope has revealed star clusters so remote as to take their light at 100,000 miles a second thirty millions of years to reach the earth.

It is estimated that, with the aid of the best glass, as many as a thousand millions of stars can be seen, and were we to quadruple the penetrating power of our glasses we should quadruple the number of visible stars. Some of them are supposed to be a thousand times larger than our Sun and we may know each and every star, by birth and law Divine, to be the centre and ruler of an Eternal Empire of shining worlds.

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We also find God's [illegible] nature indelibly stamped on nature's every feature.

In our contemplation of the innumerable systems of worlds which surround us we find our imagination overwhelmed in an eternity of varying life, beauty, and grandeur.

We see the countless orbs around us roll in flames,
And know that each a golden empire holds in chains.
We see God's fiery envoys* in magic splendor rise,
In grand electric pomp burn bright along the skies.

And like the SOLAR worlds that in OUR system gleam,
Are OTHER worlds with valleys deep and lakes in golden sheen.
We see their plains and glens, and grottos dark and wild,
And we see their lofty peaks in crystal splendor piled.

We see their oceans wide, their rivers pure and bright,
Where pearls and richer gems lie sparkling in the light.
We see their emerald seas in gold and purple bands,
Where tinted light and shade in every color blends.

And we see another broader, brighter world beyond the skies,
Where worth from every other clime like floral mountains rise
Around a starry canopy of living truth and love; the Goal
And Home, the Throne of Light and Life and Law, the God of ALL.

* Comets.

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